Financing Non-Residential Photovoltaic Projects:
Options and Implications

~ Report Summary Presentation ~

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January 2009

Introduction

- Growth in the non-residential PV sector has outpaced that of the residential PV sector in recent years: by one estimate, US non-residential PV capacity has grown from less than half of aggregate annual capacity installations in 2000-2002 to nearly two-thirds in 2007, with this trend expected to have continued through 2008.
- The non-residential sector's commanding lead stems from two factors: (1) greater "Tax Benefits" (i.e., ITC and accelerated depreciation) than in the residential sector, at least historically, and (2) significantly larger projects, which allow for economies of scale and therefore more-competitive projects.
- Tax Benefits provide a significant value to PV projects, but also complicate PV project finance, since many non-residential site hosts and PV project developers lack sufficient Federal income tax liability to use the Tax Benefits efficiently
- In response, PV developers have looked to the wind industry and elsewhere in search of financing structures that will attract institutional "Tax Investors" who are willing to own PV projects in order to take advantage of their Tax Benefits
- The resulting financial innovation – which is the topic of this report – has helped to overcome some of the most significant barriers facing PV adoption, including: high up-front costs, the need for a significant tax base, O&M capabilities, and willingness to shoulder performance risk

Purpose and Audience

The purpose of this report is three-fold:

1) To survey recent trends in the financing of non-residential PV projects in the United States
2) To describe and compare the various financing options available to both taxable and tax-exempt non-residential site hosts interested in PV
3) To analyze the impact of these various financing options on the "cost" of solar power

Broad audience:

1) Federal and state policymakers interested in understanding PV project finance and its impact on the price of PV power
2) The PV industry at large

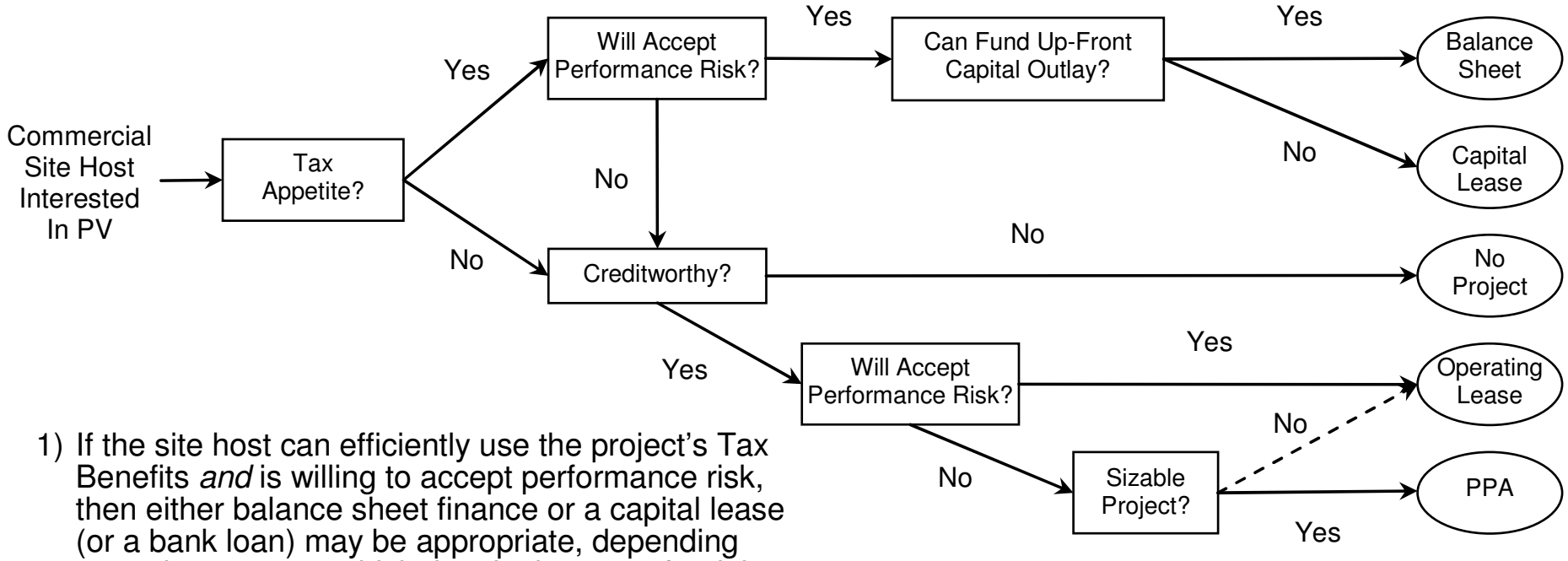
Financing Options for Taxable Site Hosts

Balance Sheet: The site host finances the project on its own balance sheet, using some internal mix of debt and equity. All the risks and rewards of ownership reside with the site host/owner.

Operating Lease: The site host leases the project from a leasing company, which utilizes the Tax Benefits and passes them through to the site host in the form of lower lease payments. This structure eliminates the need for the site host to have a strong tax base, but still leaves performance risk with the site host.

Power Purchase Agreement (PPA): Site host neither owns nor leases the project, but instead hosts the project and purchases its power over an extended (e.g., 20-year) period. The developer finances the project either in partnership with or through a sale/leaseback with a Tax Investor, who not only monetizes the Tax Benefits but also shoulders performance risk.

Taxable Site Hosts: Choosing A Finance Structure



1) If the site host can efficiently use the project's Tax Benefits *and* is willing to accept performance risk, then either balance sheet finance or a capital lease (or a bank loan) may be appropriate, depending upon the extent to which the site host can fund the up-front cost of the system.
2) If the site host has no tax appetite but is creditworthy (ideally with an investment-grade rating), then either an operating lease or a PPA would seem to be most logical, depending primarily upon the host's willingness to accept performance risk, and to a lesser extent on system size – leases are arguably more-suitable than PPAs for smaller projects.
3) If the site host is not sufficiently creditworthy to support a lease or a PPA, and also has limited tax appetite (or perhaps has adequate tax appetite but is not willing to accept performance risk), then it will be difficult to structure an economically viable project, although some PPA providers are reportedly beginning to offer terms to less-creditworthy site hosts

Financing Options for Tax-Exempt Site Hosts

Balance Sheet: A tax-exempt site host lacking bonding authority may decide to finance a PV project on its balance sheet (may be only direct ownership option for non-governmental, non-profit site hosts)

Municipal Bonds: A governmental site host finances the full cost of the project through low-cost, tax-advantaged municipal debt

Clean Renewable Energy Bonds (CREBs): Bondholder receives a tax credit instead of an interest payment, leading to 0% debt financing (at least in theory – high transaction costs add to expense, increasing borrowing cost above 0%)

Tax-Exempt Lease: Also known as a municipal lease; a capital lease to own the PV project over time. Though easier to access than muni bonds, also higher cost because of non-appropriations and non-substitution clauses.

Service Contract: Same as a PPA with a taxable site host, but explicitly structured as a service contract in this case, so as not to be mis-construed as a lease. Developer finances the project either in partnership with a Tax Investor, or through a sale/leaseback structure.

Pre-Paid Service Contract: Like a normal service contract, but site host issues tax-advantaged muni debt to pre-pay for a portion of the power generated by the project, with the rest purchased over time. The project benefits from low-cost muni debt as well as private Tax Benefits.

Modeling Approach

- Berkeley Lab has developed simplified pro forma financial models for each financing structure of interest.
- The general approach common to these models is to start with a series of user-defined assumptions about the PV system, as well as the financial constraints imposed by the various investors in that system (e.g., return targets, debt coverage ratios, etc.), and then to back into a required amount of revenue that will satisfy all constraints.
- In all cases, the financial analysis ignores the impact of power bill savings on site host economics, under the assumption that power bill savings will not differ under the various financing structures examined. Instead, the analysis focuses on the site host's *cost of procuring those power bill savings*, whatever they may be.
- In other words, the model calculates the amount of incremental revenue (above and beyond any rebates or tax incentives, and consisting of both power bill savings and any additional revenue from the sale of the project's RECs) required for the project to make economic sense. If the power bill savings (plus any REC revenue) are expected to be higher than the modeled revenue requirement, then the project will likely be economical (presuming the model's assumptions reflect reality over time).
- These simplifying assumptions greatly reduce the complexity of the modeling, since power bill savings in particular will depend on a variety of factors, including retail rate structure, site host load shape, and net metering policies, and must be modeled over shorter time scales than are appropriate or otherwise necessary for this report.

Generic Modeling Results for Taxable Site Hosts

	Balance Sheet	Operating Lease	PPA (Partnership)
ASSUMPTIONS			
System Size (kW_{DC})		500	
Installed Cost ($/$kW_{DC}$)		$6,000	
Annual Performance (kWh/kW_{DC})		1,350	
Performance Degradation (%/year)		0.5%	
Annual O&M Cost ($/$kW_{DC}$-year)		$30	
Annual O&M Escalation (%/year)		3%	
Period of Analysis (years)		20	
State Incentive Type		NONE	
State Incentive Level		NONE	
PV Price Escalator	4%		4%
Flip Point Target (year)			18
Lease Term (years)		20	
Residual Value (% of installed cost)		20%	
Debt Leverage (% of installed cost)		0%	
RESULTS			
First-Year Revenue ($/kWh)	0.336	0.397	0.270
Levelized 20-Year Revenue ($/kWh)	0.441	0.413	0.354
Tax Investor 20-Year After-Tax IRR		10.0%	7.0%
Developer 20-Year After-Tax IRR			20.0%
Project 20-Year After-Tax IRR	10.0%	10.0%	7.7%

- Assumes no state-level incentives
- Fact that PPA is most economical (i.e., has the lowest revenue requirements) is attributable to presence of low-cost tax equity (i.e., at the project level, return requirements of 7.7%, versus 10% for the other two structures).

Generic Modeling Results for Tax-Exempt Site Hosts

	Balance Sheet	Muni Bonds	CREBs	Tax-Exempt Lease	Service Contract (Partnership)	Pre-Paid Service Contract
ASSUMPTIONS						
System Size (kW_{DC})	500					
Installed Cost ($/$kW_{DC}$)	$6,000					
Annual Performance (kWh/kW_{DC})	1,350					
Performance Degradation (%/year)	0.5%					
Annual O&M Cost ($/$kW_{DC}$-year)	$30					
O&M Escalation (%/year)	3%					
Period of Analysis (years)	20					
State Incentive Type	NONE					
State Incentive Level ($/kWh)	NONE					
PV Price Escalator	4%				4%	
Flip Point Target (year)					18	
Lease Term (years)				20		
Residual Value (% of installed cost)				0%		
Debt Term (years)		20	15			20
Debt Interest Rate		5%	1%			5%
Debt Service Coverage Ratio		1.0	1.0			1.0
Debt Leverage (% of installed cost)		100%				30%
RESULTS						
First-Year Revenue ($/kWh)	0.432			0.442	0.270	0.240
Levelized 20-Year Revenue ($/kWh)	0.568	0.397	0.328	0.462	0.354	0.284
Tax Investor 20-Year After-Tax IRR				7.0%	7.0%	7.0%
Developer 20-Year After-Tax IRR					20.0%	18.3%
Project 20-Year After-Tax IRR	10%			7.0%	7.7%	7.5%

- Assumes no state-level incentives
- Loss of Tax Benefits adds $0.12/kWh to Balance Sheet model ($0.568/kWh vs. $0.441/kWh), but all other structures available to tax-exempt entities (except Tax-Exempt Lease) still better off

Base-Case Modeling Results for Taxable Site Hosts in California

	Balance Sheet	Operating Lease	PPA (Partnership)
ASSUMPTIONS			
System Size (kW_{DC})		500	
Installed Cost ($/$kW_{DC}$)		$6,000	
Annual Performance (kWh/kW_{DC})		1,350	
Performance Degradation (%/year)		0.5%	
Annual O&M Cost ($/$kW_{DC}$-year)		$30	
Annual O&M Escalation (%/year)		3%	
Period of Analysis (years)		20	
State Incentive Type		5-Year PBI	
State Incentive Level ($/kWh)		0.22	
PV Price Escalator	4%		4%
Flip Point Target (year)			18
Lease Term (years)		20	
Residual Value (% of installed cost)		20%	
Debt Leverage (% of installed cost)		0%	
RESULTS			
First-Year Revenue ($/kWh)	0.267	0.313	0.206
Levelized 20-Year Revenue ($/kWh)	0.351	0.326	0.270
Tax Investor 20-Year After-Tax IRR		10.0%	7.0%
Developer 20-Year After-Tax IRR			18.8%
Project 20-Year After-Tax IRR	10.0%	10.0%	7.6%

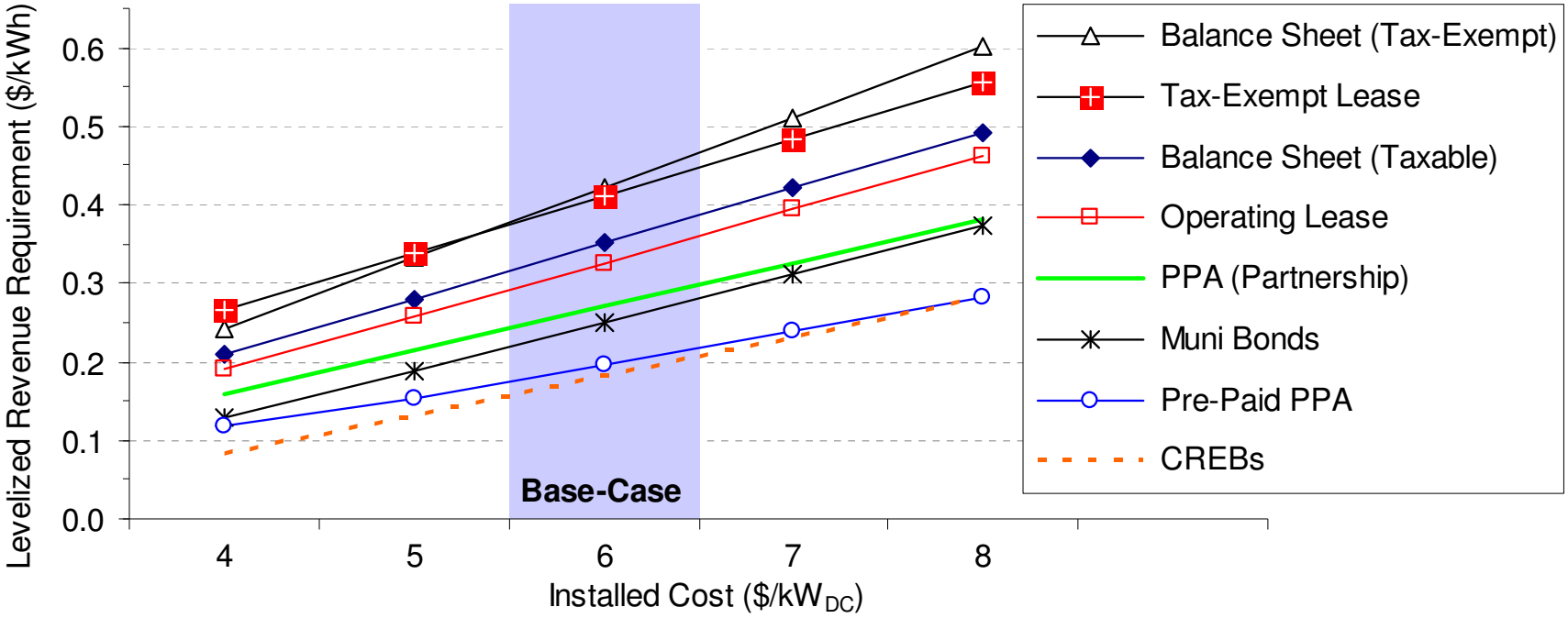
Once 5-year PBI of $0.22/kWh (Step 5 of the CSI) is included, then first-year revenue requirements fall into a range that is potentially competitive with utility rates in California (e.g., $0.206/kWh for PPA model)

Base-Case Modeling Results for Tax-Exempt Site Hosts in California

	Balance Sheet	Muni Bonds	CREBs	Tax-Exempt Lease	Service Contract (Partnership)	Pre-Paid Service Contract
ASSUMPTIONS						
System Size (kW_{DC})	500					
Installed Cost ($/$kW_{DC}$)	$6,000					
Annual Performance (kWh/kW_{DC})	1,350					
Performance Degradation (%/year)	0.5%					
Annual O&M Cost ($/$kW_{DC}$-year)	$30					
O&M Escalation (%/year)	3%					
Period of Analysis (years)	20					
State Incentive Type	5-Year PBI					
State Incentive Level ($/kWh)	0.32			0.22		
PV Price Escalator	4%				4%	
Flip Point Target (year)					18	
Lease Term (years)				20		
Residual Value (% of installed cost)				0%		
Debt Term (years)		20	15			20
Debt Interest Rate		5%	1%			5%
Debt Service Coverage Ratio		1.0	1.0			1.0
Debt Leverage (% of installed cost)		100%				30%
RESULTS						
First-Year Revenue ($/kWh)	0.321			0.393	0.206	0.172
Levelized 20-Year Revenue ($/kWh)	0.422	0.251	0.182	0.411	0.270	0.195
Tax Investor 20-Year After-Tax IRR				7.0%	7.0%	7.0%
Developer 20-Year After-Tax IRR					18.8%	13.0%
Project 20-Year After-Tax IRR	10%			7.0%	7.6%	7.2%

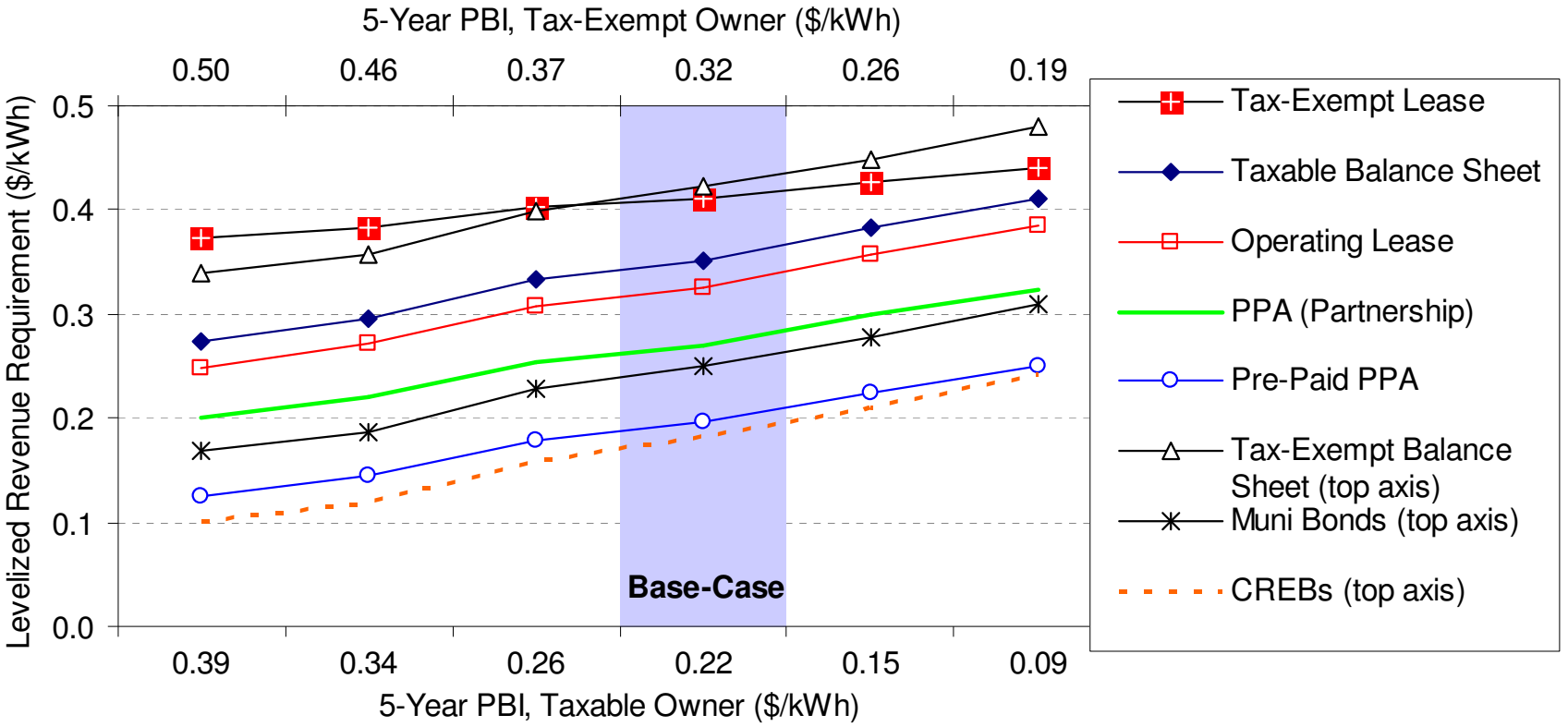
Differentially higher PBIs for tax-exempt owners changes relative ranking, with CREBs and Muni Bonds now among the cheapest options

Sensitivity to Installed Costs (California Project)



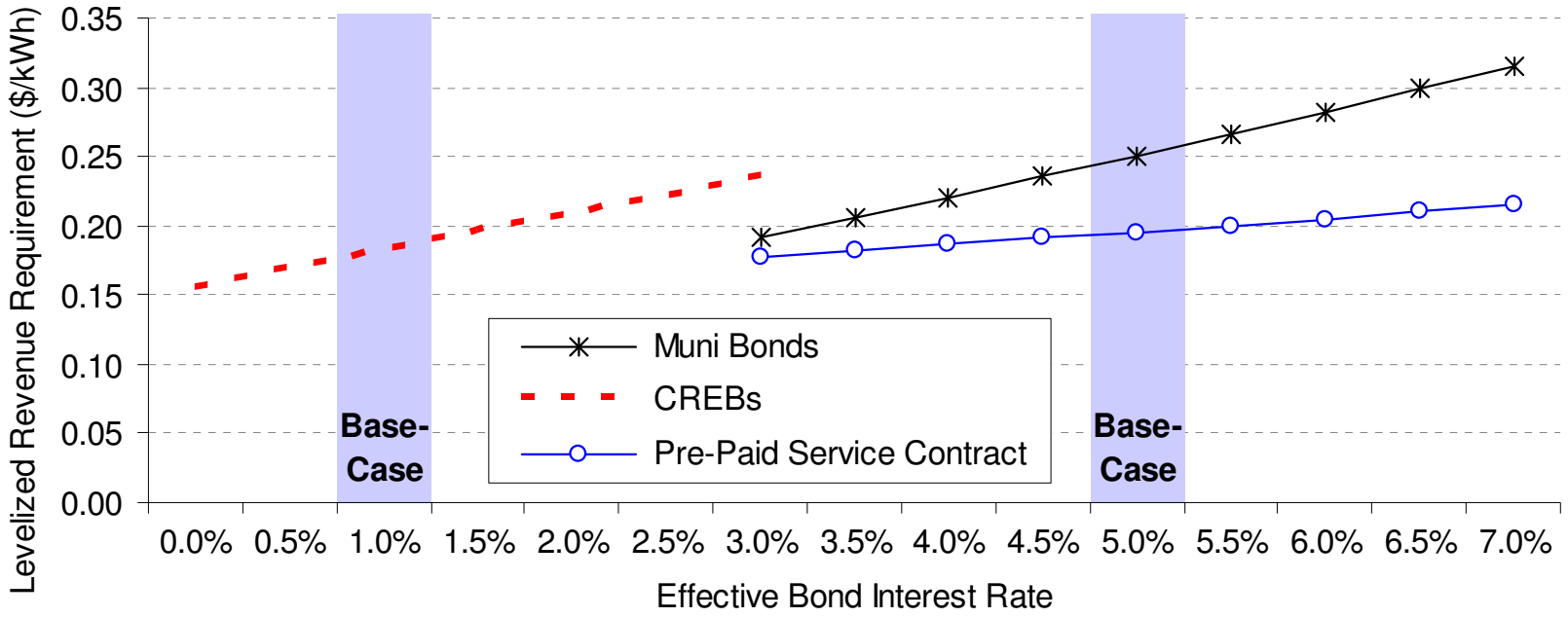
- As installed costs drop from the \$6/W_{DC} base-case assumption to \$5/W_{DC}, required revenue falls by \$0.04/kWh to \$0.09/kWh (\$0.06/kWh on average), making the solar sale significantly easier

Sensitivity to PBI Level (California Project)



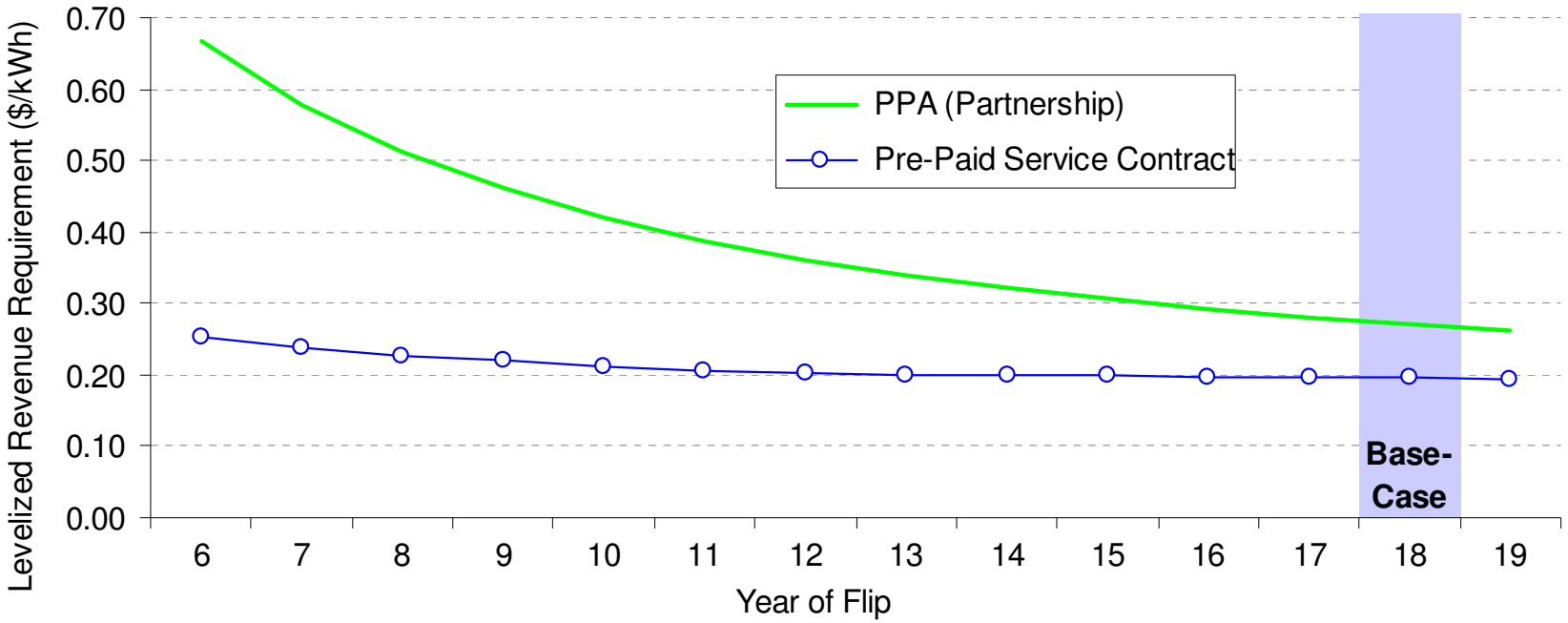
- As PBI payments decline from Step 5 (of the California Solar Initiative) to Step 6, required revenue increases by about $0.03/kWh on a 20-year levelized basis

Sensitivity to Bond Interest Rate (California Project)



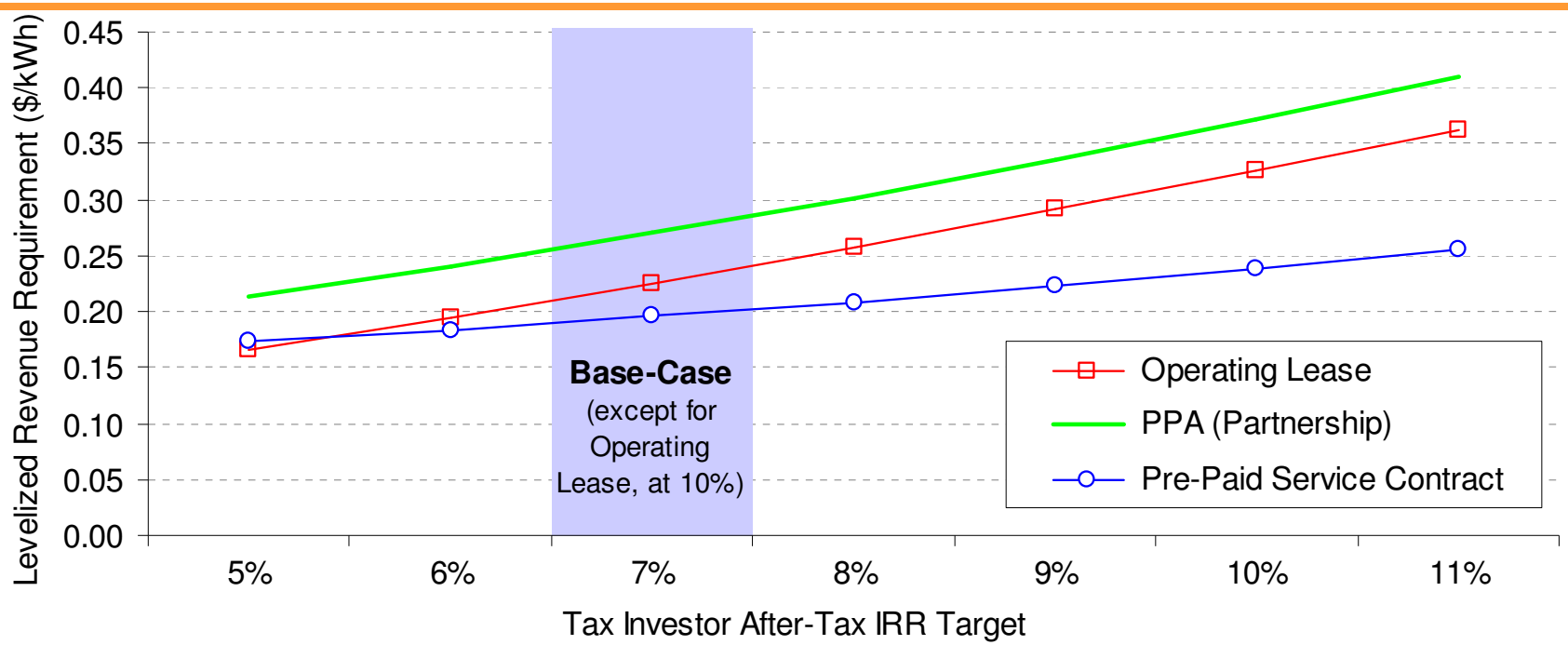
- 1% CREB base-case (vs. 0%) is intended to account for transaction costs
- At 3%, CREBs require more revenue than muni bonds because CREB term is shorter (assumed 15 years vs. 20 for muni bonds) and because original CREB regulations required repayment of principal in equal installments, which leads to higher debt service burden (and hence revenue requirements) in early years
- Pre-paid service contract not as impacted due to limited leverage (30%)

Sensitivity to Flip Date (California Project)



- Even though the flip could conceivably occur as early as the end of year 6 (by which time the project's Tax Benefits have largely run their course), in practice the need to have revenue requirements approach utility rates (absent high REC pricing) does not typically allow a flip in cash and tax allocations prior to the project entering its late-teen years
- The Pre-Paid Service Contract is not nearly as sensitive to changes in the flip date, because the pre-payment amount – which accounts for roughly half of revenue requirements – is not at all impacted by that flip date

Sensitivity to Tax Investor IRR Target (California Project)



- Tax equity yields are reportedly 200 basis points higher since the start of the financial crisis
- Moving from 7% base-case to 9% pushes levelized revenue requirements up by roughly 7 cents/kWh, with the exception of the Pre-Paid Service Contract, which is not as sensitive to this variable since it does not impact the portion of the project that has been pre-paid and is financed by municipal debt

Translating Tax Equity Yields into Installed Cost Terms (California Project)

- Another way to think about the recent increase in tax equity yields is to translate them into installed cost terms: by how much would installed costs need to fall in order to exactly offset the recent increase in tax equity yields?
- According to the PPA (Partnership) model with base-case California assumptions, installed costs would need to drop to nearly \$5.00/W_{DC} (or by almost \$1.0/W_{DC}) in order to maintain the same revenue requirements (both first-year and levelized) in the face of tax equity yields rising from 7% to 9%.
- Taking this analysis one step further, if the 20-year after-tax IRR hurdle rate remains at 9% over time, then installed costs must drop further to \$4.56/W, \$4.16/W, and \$3.89/W as PBI levels decline in the future to \$0.15/kWh, \$0.09/kWh, and \$0.05/kWh (Steps 6-8 of the CSI), respectively, in order to maintain the base-case revenue requirements of \$0.206/kWh and \$0.270/kWh (first-year and levelized, respectively)

A Brief Look at Two Other Markets

- All analysis presented earlier considered any SREC value as one of two contributors (the other being power bill savings) to system revenue requirements
- Two other markets – Colorado and New Jersey – have more explicitly defined SREC value through RPS set-asides
- **Colorado:**
  - Systems sized between 10 kW and 100 kW receive not only a $2/W CBI, but also a 20-year SREC contract priced at $0.115/kWh
  - Yields a levelized revenue requirement of just $0.084/kWh
- **New Jersey:**
  - PV projects in New Jersey are eligible to compete for 15-year solar REC contracts with the obligated utilities, with pricing in excess of $0.30/kWh
  - Assuming $0.30/kWh yields a 20-year levelized revenue requirement of just $0.09/kWh
- Note that these are "post-REC" revenue requirements that must be met solely with power bill savings (and are therefore not directly comparable to the results presented earlier, where more-modest and uncertain REC prices were not broken out into a separate revenue stream)

Challenges to Third-Party Ownership

- **Declining state-level incentives:** In the largest U.S. PV markets, state-level incentives have been declining faster than installed costs, which makes a solar PPA a harder sell
- **Credit quality:** Lessee or power purchaser must generally have an investment-grade rating in order to support a 15-20-year lease or PPA
- **The financial/credit crisis:** Has diminished the ranks of creditworthy site hosts, as well as Tax Investors (and those still in the market require higher yields)
- **Legality of third-party ownership:** Two issues – (1) whether third-party owned systems are eligible for net metering, and (2) whether PPA providers should be regulated like utilities – are being debated in a number of states. A few states, including Oregon and Nevada, have ruled definitively in favor of third-party ownership.

Policy Implications

Federal

- Sizable Tax Benefits clearly favor ownership by taxable entities…but tax-exempt entities may do just as well tapping into tax-advantaged debt (muni bonds and CREBs), differentially higher state-level incentives for tax-exempt owners (in some states), or even third-party ownership
- Up-front nature of the ITC requires significant tax capacity in the project's first year (compared to a wind project taking the PTC over 10 years), which has left the sector vulnerable to the financial crisis. On the other hand, Tax Investors are better able to predict their tax capacity out one year than out ten years.
- Allowance of leasing under Section 48 ITC is a plus (leasing not possible for wind projects under Section 45 PTC)

State

- Trend away from CBIs towards PBIs and SRECs has hastened the rise of third-party ownership, to address higher up-front costs (post-rebate) and performance risk
- Third-party ownership highlights pre-existing issue of "system permanence" – whether systems that receive state- or utility-level incentives can eventually be relocated to other areas (e.g., when PPAs end, or in a default situation)
- Legality of third-party ownership is a question in some states (see previous slide)
- Setting the right incentive level is made more difficult by exogenous financial shocks
- Given other financing options, including third-party ownership, differentially higher state-level incentives for tax-exempt owners may not be needed

Conclusions

Financial innovation in the non-residential PV market over the last five years has been more revolutionary than evolutionary in nature:

- The rise of third-party ownership has been a primary driver of the strong growth of PV in the non-residential sector

Looking ahead, ongoing financial innovation is likely to be more evolutionary than revolutionary:

- Eight-year extension of 30% ITC provides long-term policy stability…
- … but financial crisis restricts the flow of tax equity and exacerbates affordability challenge through higher tax equity yields

Tweaks to product offerings attempt to ease the solar sale:

- Packaging energy efficiency with solar to reduce overall payback
- Asking site host to share in O&M costs
- Debt financing at project or portfolio level looking more attractive as a way to boost investor returns while maintaining competitive PPA prices

More substantial twists to existing structures may also emerge:

- Pre-paid service contract for tax-exempt site hosts may gain popularity
- Structures that can better accommodate cash investors may emerge
- Increased utility ownership likely starting in 2009

For More Information

1) Download the full report at:

http://eetd.lbl.gov/ea/emp/re-pubs.html

or

http://eetd.lbl.gov/ea/emp/reports/lbnl-1410e.pdf

2) Contact the author:

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